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What is claimed is:

1. A method for determining a two phase flow rate of a fluid mixture through a vessel, said fluid mixture comprising at least a first fluid component characterized by a first phase and a second fluid component characterized by a second phase, the method comprising:

(col. 2, lines 21-23 (col 2, lines 24-28)

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A. performing a tomography measurement of said fluid mixture flowing through said vessel so as to determine a ratio ρ between said first component and said second component within said fluid mixture; (

B. obtaining a first approximate flow measurement and a second approximate flow measurement by using a first and a second transducer sensor to transmit a wave through said fluid mixture and detect the transmitted wave; and (Col 9, lines 15-20)

C. computing said two phase flow rate of said fluid mixture as a known function of said ratio ρ, said first and second flow measurements, and the direction and speed of transmission of said wave. (Col. 2, lines 36-38)

2. A method in accordance with claim 1, wherein said tomography measurement comprises an ECT (Electrical Capacitance Tomography) measurement.

3. A method in accordance with claim 1, wherein the step of determining said ratio of said first component to said second component comprises the step of measuring a distribution of dielectric permittivity within said vessel.

4. A method in accordance with claim 3, wherein the step of measuring a distribution of dielectric permittivity within said vessel comprises measuring the electrical capacitances between one or more pairs of electrodes placed around the periphery of a capacitance tomography unit.

5. A method in accordance with claim 1, wherein at least one transducer sensor comprises an ultrasound sensor, and wherein said wave comprises an ultrasound wave.

6. A method in accordance with claim 1, wherein said at least one transducer sensor comprises:

a) a first ultrasound sensor for providing said first flow measurement, and

b) a second ultrasound sensor for providing said second flow measurement, and wherein said wave comprises a first ultrasound wave propagating at an angle with respect to the direction of flow of said fluid mixture, and a second ultrasound wave propagating at another angle with respect to the direction of flow of said fluid mixture.

7. A method in accordance with claim 6, wherein said first ultrasound sensor comprises a first ultrasound transmitter for generating said first ultrasound wave and transmitting it through said fluid mixture, and a first ultrasound receiver for receiving said transmitted ultrasound wave; and

wherein said second ultrasound sensor comprises a second ultrasound transmitter for generating said second ultrasound wave and transmitting it through said fluid mixture, and a second ultrasound receiver for receiving said transmitted ultrasound wave.

8. A method in accordance with claim 1, wherein said transducer sensor comprises a pressure sensor, and said wave comprises a pressure wave.

7. A method in accordance with claim 1, wherein said vessel is characterized by a tubular configuration, and wherein transducer sensor is disposed on the surface of said vessel.

8. A method in accordance with claim 1, wherein said transducer sensor comprises a thermal sensor, and said wave comprises a thermal wave.

9. A method for determining a two phase flow rate of a fluid mixture through a vessel, said fluid mixture comprising at least a first fluid component characterized by a first phase and a second fluid component characterized by a second phase, the method comprising:

A. performing a tomography measurement of said fluid mixture flowing through said vessel, so as to determine a concentration ratio ρ of said first component to said second component in said fluid mixture;

B. transmitting a first ultrasonic wave through said fluid mixture, and measuring the speed and direction of progagation of said first ultrasonic wave;

C. transmitting a second ultrasonic wave through said fluid mixture, and measuring the speed and direction of progagation of said second ultrasonic wave; and

D. computing said two phase flow rate of said fluid mixture using a known relationship between said two phase flow rate, said ratio ρ, and said speed and direction of propagation of each ultrasonic wave relative to the direction of flow of said fluid mixture.

10. A method in accordance with claim 9, wherein the direction of propagation of said first ultrasonic wave makes an angle [$\pi/2$ - θ] with respect to the direction of flow of said fluid mixture;

wherein the direction of propagation of said second ultrasonic wave makes an angle [$\pi/2$ + θ] with respect to the direction of flow of said fluid mixture; and

wherein said known relationship is given by:

$$v = \frac{\sin(\theta)}{2} \cdot (u_1 - u_2)$$

where

v is said two phase flow rate of said fluid mixture ;

u_1 is said first approximate flow rate; and

u_2 is said second approximate flow rate.

11. A method in accordance with claim 10,

wherein said first approximate flow rate u_1 is given by:

$$u_1 = c_{mix} + \frac{1}{\sin(\theta)} v ;$$

further wherein said second approximate flow rate u_2 is given by:

$$u_2 = c_{mix} - \frac{1}{\sin(\theta)} v;$$

further wherein c_{mix} is the speed of sound within the fluid mixture, and is given by:

$$c_{mix} = c_{first} \cdot \rho + c_{second} \cdot (1 - \rho),$$

where

c_{first} is the speed of sound within said first fluid component,

c_{second} is the speed of sound within said second fluid component,

and ρ is said concentration ratio of said first component to said second component.

12. A method in accordance with claim 9, wherein each of said first and second phases comprises at least one of: a solid; a liquid; and a gas.

13. A system for measuring a two phase flow rate of a fluid mixture flowing through a vessel, said fluid mixture containing at least a first component characterized by a first phase, and a second component characterized by a second phase, the system comprising:

A. a tomography system for determining the concentration ratio between said first component and said second component within said fluid mixture;

B. a first sensor for providing a first approximate flow measurement for said fluid mixture;

C. a second sensor disposed at a known orientation relative to said first sensor, for providing a second flow measurement for said fluid mixture; and

D. a processor for computing the two phase flow rate of said fluid mixture using said concentration ratio, said first flow measurement, and said second flow measurement; wherein said two phase flow rate is related to said concentration ratio and to said first and second flow measurements by a known relationship.

14. A system in accordance with claim 13, wherein said first and second sensors each comprise:

a. a transmitter for transmitting a wave through said fluid mixture; and

b. a receiver for detecting said transmitted wave.

15. A system in accordance with claim 14, wherein said two phase flow rate is a function of the direction and speed of transmission of said energy.

16. A system in accordance with claim 13, wherein said first and said second sensors comprise at least one of: an ultrasound sensor; a pressure sensor; and a thermal sensor.

17. A system in accordance with claim 14, wherein said energy comprises at least one of: a) an ultrasound wave; b) a pressure wave; and c) a thermal wave.

18. A system in accordance with claim 13, wherein

a) said first sensor comprises a first ultrasound sensor for providing said first flow measurement;

b) said second sensor comprises a second ultrasound sensor for providing said second flow measurement; and

wherein said energy comprises a first ultrasound wave propagating at an angle with respect to the direction of flow of said fluid mixture, and a second ultrasound wave propagating at another angle with respect to the direction of flow of said fluid mixture.

19. A system in accordance with claim 18, wherein the direction of propagation of said first ultrasonic wave makes an angle $[\pi/2 - \theta]$ with respect to the direction of flow of said fluid mixture;

wherein the direction of propagation of said second ultrasonic wave makes an angle $[\pi/2 + \theta]$ with respect to the direction of flow of said fluid mixture; and

wherein said known relationship is given by:

$$v = \frac{\sin(\theta)}{2} \cdot (u_1 - u_2),$$

where

v is said two phase flow rate of said fluid mixture ;

u_1 is said first approximate flow rate; and

u_2 is said second approximate flow rate.

20. A system in accordance with claim 19,

wherein said first approximate flow rate u_1 is given by:

$$u_1 = c_{mix} + \frac{1}{\sin(\theta)} v;$$

further wherein said second approximate flow rate u_2 is given by:

$$u_2 = c_{mix} - \frac{1}{\sin(\theta)} v;$$

further wherein c_{mix} is the speed of sound within the fluid mixture, and is given by:

$$c_{mix} = c_{first} \cdot \rho + c_{second} \cdot (1 - \rho),$$

where

c_{first} is the speed of sound within said first fluid component,

c_{second} is the speed of sound within said second fluid component,

and ρ is said concentration ratio of said first component to said second component.

21. A system in accordance with claim 18, wherein said first and second ultrasound sensor each comprises: an ultrasound transmitter for generating an ultrasound wave and transmitting it through said fluid mixture, and an ultrasound receiver for receiving said ultrasound wave.

22. A system in accordance with claim 13, wherein said tomography system comprises an ECT (Electrical Capacitance Tomography) system for providing a distribution of dielectric permittivity within said vessel by measuring the electrical capacitances between one or more pairs of electrodes placed around said vessel.

23. A system in accordance with claim 13, wherein said vessel is characterized by a tubular configuration.

24. A system in accordance with claim 13, wherein said vessel includes at least one bend.